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Surgery in Motion

The Role of the Prostatic Vasculature as a Landmark for Nerve Sparing During Robot-Assisted Radical Prostatectomy

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Abstract

Background: Macroscopic landmarks are lacking to identify the cavernosal nerves (CNs) during radical prostatectomy. The prostatic and capsular arteries run along the lateral border of the prostate and could help identify the location of the CNs during robot-assisted radical prostatectomy (RARP).
Objective: Describe the visual cues that have helped us achieve consistent nerve sparing (NS) during RARP, placing special emphasis on the usefulness of the prostatic vasculature (PV).
Design, setting, and participants: Retrospective video analysis of 133 consecutive patients who underwent RARP in a single institution between January and February 2011.
Surgical procedure: NS was performed using a retrograde, antegrade, or combined approach.
Measurements: A landmark artery (LA) was identified running on the lateral border of the prostate corresponding to either a prostatic or capsular artery. NS was classified as either medial or lateral to the LA. The area of residual nerve tissue on surgical specimens was measured to compare the amount of NS between the groups.
Results and limitations: We could identify an LA in 73.3% (195 of 266) of the operated sides. The area of residual nerve tissue was significantly different whether the NS was performed medial (between the LA and the prostate) or lateral to the LA (between the LA and pelvic side wall): median (interquartile range) of 0 (0–3) mm^2 versus14 (9–25) mm^2; $p < 0.001$, respectively.
Conclusions: The PV is an identifiable landmark during NS. Fine tailoring on the medial border of an LA can consistently result in a complete or almost complete NS, whereas performing the NS on its lateral border results in several degrees of incomplete NS.

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1. Introduction

Preservation of the cavernosal nerves (CNs) is one of the most challenging steps during radical prostatectomy. These nerves are millimeters in size and contained within a bundle of nerves, fatty tissue, and vascular elements, and therefore they cannot be visualized during surgery [1,2]. Because surgeons must rely on their experience to identify the neurovascular bundles (NVBs) intraoperatively, the amount of nerve sparing (NS) that surgeons intend does not always correspond with the actual amount performed at the time of surgery [3,4].

The arterial supply to the prostate originates from the internal iliac (or hypogastric) artery [5,6]. The prostatic

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artery (PA) is a branch of the vesicoprostatic trunk and reaches the prostate on its anterolateral aspect at the base [6,7]. From there, it can continue distally down to the perineum or give origin to a network of capsular arteries (CAs) running along the lateral border of the prostate [5,7,8]. During their course alongside the prostate, these elements of the prostatic vasculature (PV), especially the CAs, are related intimately with the CNs and provide a scaffold to the nerves at their course along the prostate [2]. Therefore, the PV may provide a macroscopic landmark for identifying and preserving the CNs at the time of surgery.

The robotic platform provides increased magnification, better visualization, and wristed instrumentation, and it is associated with significantly decreased blood loss when compared with open surgery [9,10]. As a result, a delicate dissection can be achieved during robot-assisted radical prostatectomy (RARP) that can potentially allow for the identification of small anatomic structures such as elements of the PV that are not easily recognized during open surgery. The objective of this study was to describe the visual cues that have helped us achieve consistent NS during RARP, placing special emphasis on the usefulness of the PV as a landmark for intraoperative identification of the location and course of the NVBs.

2. Methods

The study was performed with the approval of our internal institutional review board. Data of 136 consecutive patients who underwent RARP by a single surgeon (VRP) between January and February 2011 were prospectively collected and entered into a customized database by a collaborator unrelated to the study. Three patients who underwent a salvage procedure were excluded from the analysis.

2.1. Nerve-sparing technique

Our preferred technique of NS is athermal early retrograde release of the NVB with minimization of traction [11]. After the seminal vesicles have been dissected and lifted upward, the posterior plane between the rectum and the prostate is developed through the layers of Denonvillier's fascia and extended anteriorly toward the apex and laterally until the medial aspect of the NVB is recognized bilaterally. The prostate is then rotated laterally and the levator fascia over the prostate is opened sharply to expose the NVB. A plane between the prostate and the NVB is created at the level of the midprostate and further developed until the previously created posterior plane is reached. The plane is then continued retrogradely toward the base of the prostate to completely detach the NVB from the prostatic pedicle. This allows the safe placement of a clip at the prostatic pedicle without the risk of injuring the NVB. The plane is then continued toward the apex by detaching the prostate from the NVB.

A video analysis of the 133 cases was performed to identify any visual cues that could aid in the identification of the location and course of the NVB. We paid special attention to identifying elements of the PV, specifically any arterial vessel that could aid in this purpose. In cases where a landmark artery (LA) could be positively identified, the NS technique was classified as either medial or lateral to the LA. NS medial to the LA was performed in cases of low-risk prostate cancer and some selected intermediate-risk disease (one or two cores of Gleason score 7 and T1c clinical stage). NS was performed lateral to the LA in patients with high-risk features (>cT2b or Gleason score ≥8 or prostate-specific antigen >20 ng/ml) and those with intermediate risk that did not fulfill the criteria just described.

2.2. Pathology assessment of neurovascular tissue and surgical margins

Microscopic assessment of residual nerve tissue on prostatectomy specimens was performed to quantify the amount of NS performed at the time of surgery. For this purpose, the area (length times width) of residual nerve tissue on the posterolateral aspect of the prostate was measured by an uropathologist who was blinded to the technique of NS (ie, medial or lateral to the LA).

2.3. Statistical analysis

Continuous parametric and nonparametric data are presented as mean plus or minus standard deviation and median (interquartile range [IQR]), respectively. Categorical data are presented as frequencies. The Mann-Whitney *U* test was used to compare the area of residual nerve tissue whether the NS was performed medial or lateral to the PV. All tests were two sided, and *p* values ≤0.05 were considered statistically significant. All statistical analysis was performed using SPSS v.17.0 software.

3. Results

Table 1 describes the perioperative patient characteristics. An LA was identified in 73.3% (195 of 296) of the operated sides corresponding to either a PA or CA.

3.1. Prostatic artery

After opening sharply the levator fascia over the prostate, the presence of a distinctive PA could be found between the midprostate and base. The artery entered the prostate on

Table 1 – Patient characteristics

	Mean	SD
Age, yr	60	8
	Median	IQR
BMI	28	26–31
Preoperative SHIM score	20	13–25
AUA symptom score	7	3–14
PSA, ng/ml	5.2	4.2–7
Prostate size, cm^3	48	39–61
	Frequency *n* = 133	%
Preoperative Gleason score		
≤6	70	52.6
7	47	35.3
≥8	16	12.1
Specimen Gleason score		
≤6	41	30.8
7	77	57.9
≥8	15	11.3
Clinical stage		
T1c	98	73.7
T2	33	24.8
T3	2	1.5
Pathologic stage		
T2	108	81.2
T3	25	20.3

SD = standard deviation; IQR = interquartile range; BMI = body mass index; SHIM = Sexual Health Inventory for Men; AUA = American Urological Society; PSA = prostate-specific antigen.